PLAIN WORDS

ON

Health in Homes.

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HEALTH IN HOMES,

OR,

HOW WE DAILY INVITE HEAD-ACHE, LOSS OF APPETITE, PALENESS, UNPLEASANT ODORS, LANGUOR, MALARIA, ZYMOTIC DISEASES, ETC., BY IMPERFECT HOUSE DRAINAGE.

ISSUED BY

THE GERMICIDE CO.,

Nos. 822 & 824 Broadway,

NEW YORK.

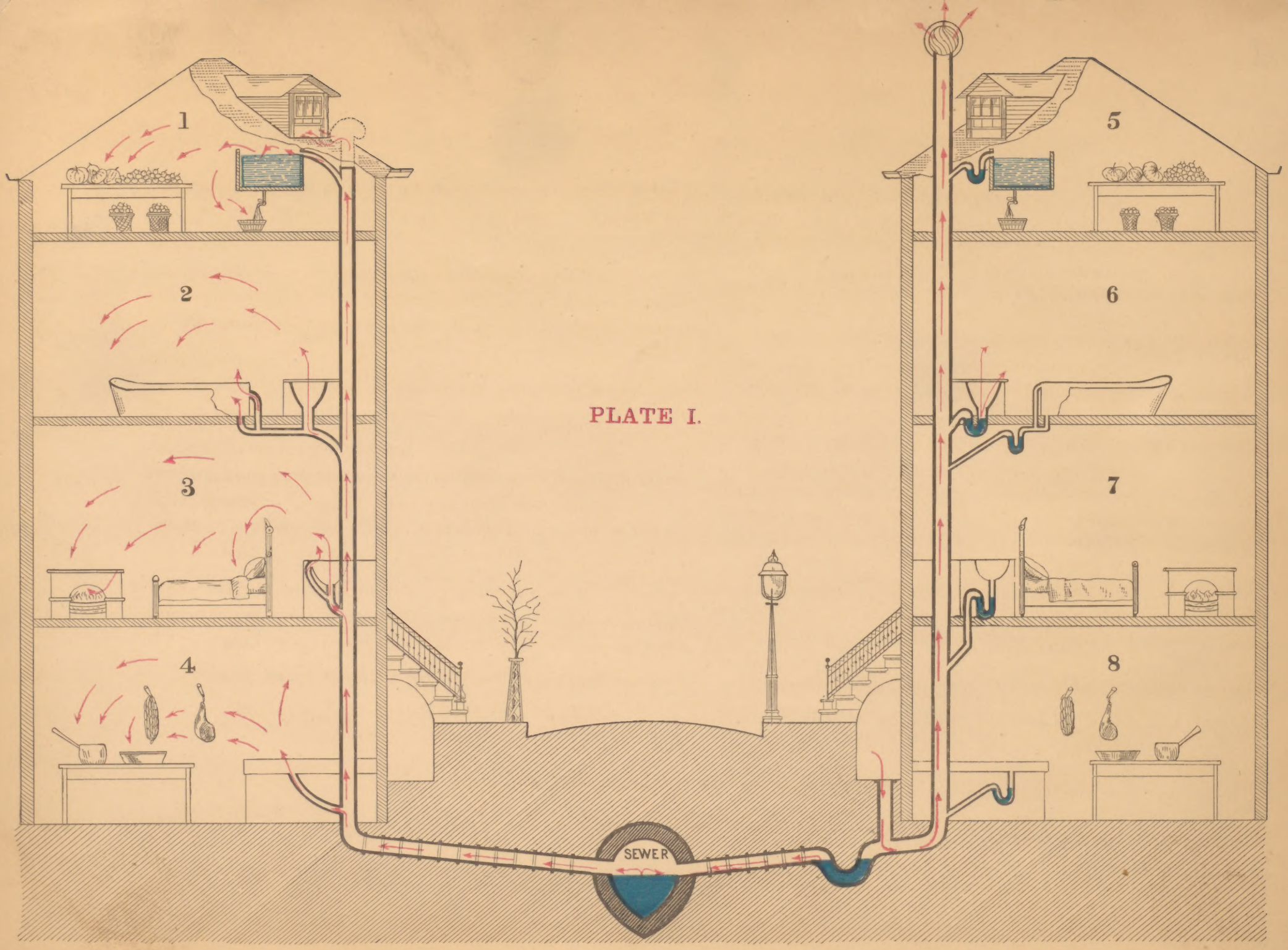


PLATE I.

MECHANICAL DEFECATION OF DRAINS.

(CLEANSING DRAINS BY WATER AND AIR.)

SEE PLATE I.

HOUSE IMPROPERLY DRAINED.

The red darts show the course sewer-gas may take.

In room 4 — a kitchen — sewer-gas is seen to enter through the untrapped sink waste-pipe, impregnating meat, milk, etc., causing them to readily spoil.

In room 3 — a bedroom — sewer-gas may bring its power to disease through the untrapped wash-bowl waste-pipe, by passing over a bed. The dart over the fire recalls the fact that foul air may be drawn into a badly ventilated room from waste-pipes.

In room 2 — a bath-room — the entrance of gas and bad odors is shown in the basin, bath-tub waste-pipe, and overflow.

In room 1 — the top floor — foul air is again seen to enter through the untrapped overflow of a water-tank, rendering such water unfit for drinking or cooking purposes.

The open window is seen to receive foul air from a low ventilator (shown by dotted lines), attached to a soil-pipe.

HOUSE WITH DRAINS TRAPPED & VENTILATED.

The imperfect drainage of the opposite house is here corrected.

A trap in the soil-pipe before it enters the sewer presents a barrier to the entrance of sewer-gas. The trapping water being represented by the blue coloring.

The air-inlet shaft under the front stoop permits a current of fresh air to enter the soil-pipe and by passing through it and out of the high ventilator on the roof, an air defecation is effected. Fresh air instead of sewer-gas thus ventilates the stand or or soil-pipe.

Each room is seen to be guarded against the entrance of foul air by traps in the waste-pipes.

The water closet — room 6 — is seen however still to receive foul air, as indicated by the darts.

This is owing to the fact that although the air within the soil-pipe is free from sewer-air, still it is not sufficiently purified, but that on passing through the trapping-water by ABSORPTION, it may become manifest.

The trap and receiver within the water closet may become foul, and thus a small cesspool is formed which may continually evolve impure air.

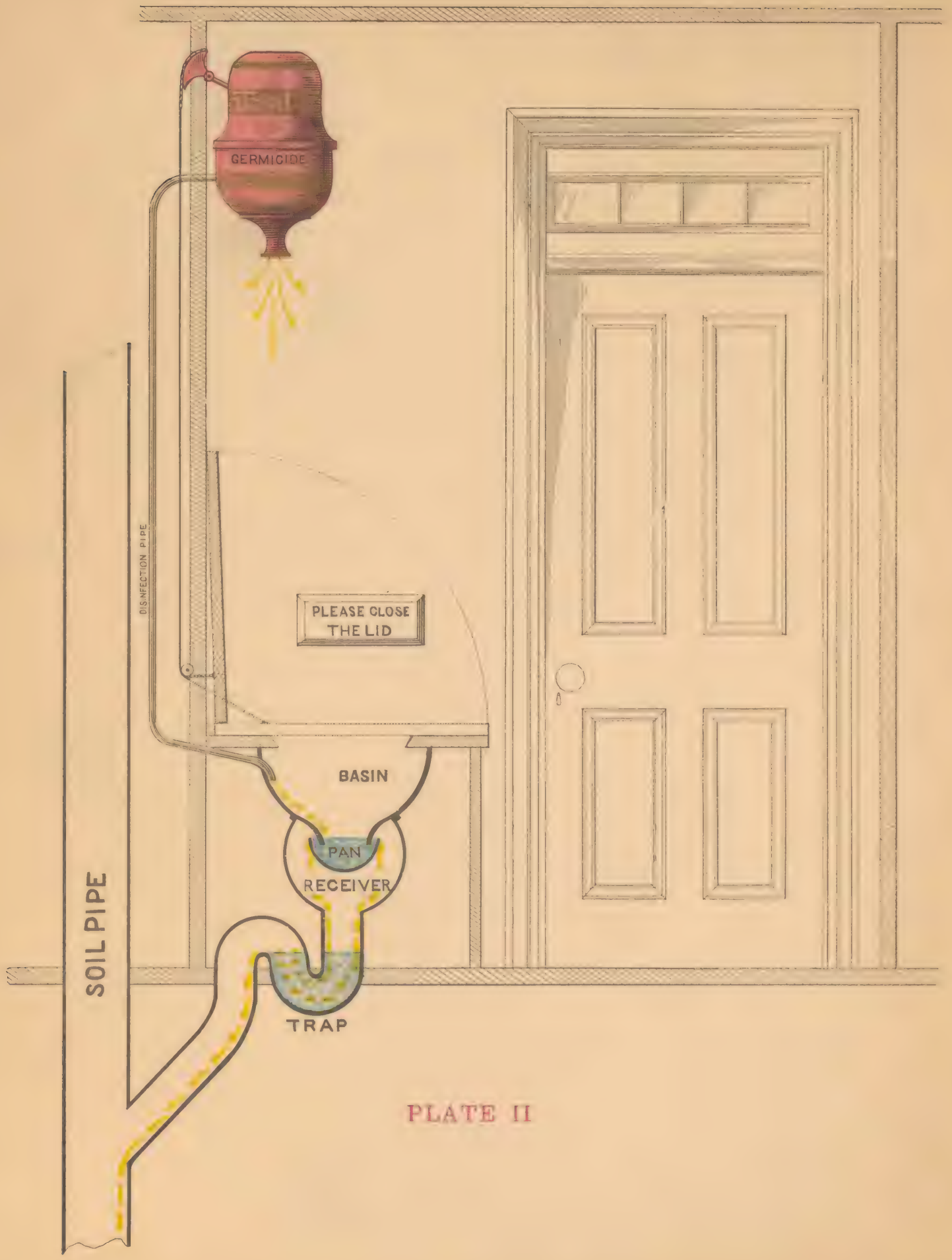

GERMICIDE
DISINFECTION PIPE
PLEASE CLOSE
THE LID
BASIN
PAN
RECEIVER
SOIL PIPE
TRAP

PLATE II

CHEMICAL DEFECATION OF DRAINS.

(PURIFYING DRAINS BY DISINFECTION.)

SEE PLATE II.

A properly constructed Water Closet may be unhealthy or disagreeable from the following causes:

I.—The water in the trap permits foul air to pass through it by absorption.

II.—The trap may become a cesspool from which odors are evolved.

III.—The trap may get emptied of its water, from causes which will be explained.

IV.—Emanations may arise from the person.

The opposite plate shows a GERMICIDE (or germ-killer) above the seat, from which the disinfecting pipe passes into the basin.

The yellow drops from this Continuous Disinfector show the course the cleansing fluid takes on its way to the soil-pipe.

The deficiencies of Mechanical Defecation are met by the Germicide system, as follows:

I.—The water in the trap is constantly impregnated with a disinfecting fluid which prevents the formation of foul gases, and neutralizes any gases that may be absorbed.

II.—The accumulation of excreta in traps is temporarily disinfected while still within the house drains, on its way to the sewer.

III.—The continuous flow of liquid from the GERMICIDE constantly renews the water of the trap, and refills it should it become dry.

IV.—The air of the Water Closet is always disinfected and perfumed each time the closet is used.

The darts seen to issue from the trumpet mouth show the course of the disinfecting and aromatic vapor which mingles with the closet air. The mere effort of raising the lid before sitting actuates a pneumatic appliance within the GERMICIDE, which expels the vapor. On closing the lid the disinfecting vapor is prepared for the next comer. The GERMICIDE is replenished once a month by an inspector, and thus, without attention from the house inmates, they are constantly protected from a subtle enemy to health and comfort.

PREFACE.

The object of this circular is to show, in a popular way, what are the possibilities of the art of plumbing with reference to domestic sanitation, and to attempt to show why mechanical appliances, unaccompanied by systematic disinfection, are insufficient to insure health in homes.

Results, obtained strictly from experimental proceedings in about one hundred localities in this city, were sufficiently gratifying to cause the organization of the "Germicide Company," having as its object the chemical defecation or disinfection of closets and soil-pipes.

The theoretical considerations and deductions briefly referred to in this preface, are addressed more particularly to the medical profession, sanitarians, and others interested in preventive medicine.

To popularize the use of disinfection as a sanitary precaution within our dwellings, low cost of material used, together with a recognized efficiency, are essential.

Whatever is considered to be the effect of a disinfectant or antiseptic upon disease germs, whether it is a catalytic action or coagulation of albumen, etc., etc., the action is referable to that existing between one or more molecules of the disinfecting material upon the physical nucleus of disease termed a morbid bioplast, or disease germ.

As contagion is not a gaseous or vapory emanation, but consists physically of minute solid particles, not subject to definite laws of diffusion, but capable of existing in large or small numbers in any given space of air, it is obvious that intensity of infection is in a direct ratio to the number of germs existing in the air that a person may inhale.

If but one germ should be floating in a room, the *chances* of infection would be just one hundred times less than if a hundred germs existed within the same space, providing the persons entering were equally susceptible to contagion, "or in other words, double the number of germs and you double the danger; diminish the size of the room by one-half and you do the same." The same holds good whether disease germs are diffused in air or water; and if we consider an aerial or a liquid disinfectant to be composed of physical points called molecules, and that the action of a disinfectant, or any form of matter, is merely the aggregate action of its molecules, it follows that the more molecules there are present in any space, the greater are the *chances* that a disinfecting molecule will come in contact with a disease germ. Again, if we consider any putrescible substance, before putrescence has actually been incited, as merely a nidus, or favorable place for the growth and increase, not of innate germs, but of germs floating in the ambient air, it is obvious that the actual amount of any antiseptic necessary to prevent putrescence must always be variable, and, aside from its colytic qualities, must be present in variable quantity to overcome the varying germ action of the atmosphere.

Therefore, experiments cannot indicate to what degree of attenuation an antiseptic can be subjected to, unless the actual number of disease germs which may chance to come in contact with it from the surrounding air is known. As this cannot be ascertained, it follows that the power of an antiseptic is necessarily variable, and its degree of attenuation compatible with its power to prevent putrescence is at all times contingent on the particular number of germs the surrounding air or water may contain at any particular time.

In the antiseptic action of chemicals upon excreta passing through house drains, where a *temporary* action is alone demanded, no theoretical considerations can lead us to predict just how much of any given antiseptic would be required to prevent initiative fermentation. The most that can be done is to use that quantity which actual practice shows to be sufficient in each particular case.

An aerial disinfectant employed to stamp out *large numbers* of disease germs, experience seems to show must be used in such quantities as to be hurtful to animal life. An aerial antiseptic however, employed to render the air unfavorable to the increase of many germs from a few, lessens the *chances* of infection, because it prevents the increase of germs numerically in any particular space, besides rendering the air unfavorable to the existence of those already developed.

The use then, of aerial antiseptics is not only rational but demanded, in air spaces continually exposed to the entrance of germs, and which animals are not *constantly* living and breathing, such as the air of a water-closet.

If, as an aerial antiseptic one is used not possessing a strong or irritating odor, and which can, therefore, be used in such quantities as to render it even a true aerial disinfectant, as well as an antiseptic, the additional advantage of maintaining closet air unfavorable to germ life without masking the odor of effluvia by a more powerful one, seems to be realized.

The method of proof regarding the value of aerial and liquid antiseptics as employed by the Germicide which only produces the aerial antiseptic during the time a closet is used, and does not permit a *constant* evaporation, diffusion, and odor of the same, aside from any *a priori* considerations, seems to reside in the fact, that as sewer gas and house drain gas invariably possess odor, although sometimes barely appreciable until the attention is called to it, and that, as such odor disappears from the closet without being covered up or masked by another odor, that the absence of such odor is more than presumable evidence that a change in the air has occurred affecting the habitat of germs certainly in a way favorable to the hygienic condition of the air. The vapor of thymol issuing from the Germicide is not an odorizer, but a true disinfectant, and is sufficiently so to actually destroy living bacteria.

Disinfection should in no case be employed when radical imperfections or defective plumbing cause house drains to imperil health. Mechanical perfection, however, in the construction and ventilation of drains, traps, etc., has in practice shown that gases from the sewer, as also those generated within the house drains and traps, whether very slightly or very strongly odorous, are not excluded from the house by the present state of the art of plumbing.

The absorption of air or gas by water in traps, the emptying of traps by syphonage or evaporation, the fact that traps, receivers, angles, etc., by collecting and retaining fæcal

matter, cause the generation of impure air within the house, produce results not as yet overcome by the mechanical defecation of house drains.

As an adjunct to the best and average plumbing and ventilation of soil-pipes, and only in the absence of serious defects should disinfection be considered as essential to the water carriage system.

Careful experiments, extending over a series of months, in about a hundred different localities in this city, where the best and the worst plumbing existed, has shown that in all cases where a water-closet existed sewer gas was more or less dominant, and that in every such instance gratifying results were produced by the combined action of *intermittent* aerial and *continuous* liquid disinfection.

As the drainage system necessarily creates local cesspools within the house, disinfection is consequently as applicable to the water system as to the privy vault system, with this material difference, however, that in the privy vault system the object is to actually disinfect large masses of material in which fermentation may have already existed for some time, while, in the disinfection of house drains, or the atmosphere of a water-closet, a totally different object is to be obtained, namely an antiseptic or preventive action.

The reason why continuous disinfection has given under widely different circumstances such a uniform result is because it does not alone flush the drains occasionally with a large amount of disinfecting material which would only remain temporarily within the drains, but it causes a constant stream to exert a preventive or antiseptic action on any morbid bioplasm which might exist within the air or water of drains.

The disinfectants used in the appliance which has been named a "Germicide" or germ-killer, and which is pictured in Plate II., are chloride of zinc and thymol.

The former, called when dissolved in water Burnett's Disinfecting Fluid, is so well known to possess the required properties that further concurrent testimony seems superfluous.

As an aerial antiseptic or mild disinfectant thymol is an appropriate substance, owing to its freedom from a strong and overpowering odor, which, like that of carbolic acid, so predominates over other milder, although poisonous effluvia, that we may be left in doubt as to whether the hurtful odor is really extinguished or merely compounded with that of carbolic acid.

If a powerful disinfectant is to be used, then sulphurous acid, chlorine, etc., must be employed in sufficient quantity to render the air irrespirable; but when a mild disinfecting or antiseptic action is demanded in circumscribed air-spaces, then the material employed should not have of itself sufficient odor that by any chance it could mask the real odor we seek to destroy, but by combining with the hurtful destroy all strong odor. If a strong-smelling aerial disinfectant is employed as the unwashed sometimes use perfume, no real sanitary results are likely to accrue.

Some interesting experiments made in New Orleans during the yellow fever epidemic, from September 9th to November 24th, by Mr. Van Slootin, have shown a relation to exist between the contagiousness of disease and the actual amount of albumenoid ammonia in the air, the latter being considered the ponderable and essential form of matter accompanying disease-germ life. He found that when yellow fever was at its height 1,000,000 cubic feet of air contained 400.75 grains of albumenoid ammonia, and that as the epidemic

declined the amount of such ammonia also declined in quantity, until when the epidemic had expended its fury the amount decreased to 47.25 grains.

As aerial disinfection, as employed by the Germicide, is not intended to stamp out large numbers of disease-germs, as would be the desired result during an epidemic, but merely to maintain the air of a closet unfavorable to germ life, a proportionately smaller amount of disinfecting material is required. Assuming, however, that in every 1,000 cubic feet of closet air 4.007 grains of albumenoid ammonia existed, the quantity proportionately found in 1,000,000 cubic feet of air during the said epidemic, and that an equal weight of thymol would be required to counteract the contagious action of such air, then if 4.007 grains of thymol are volatilized in every closet 10 feet square and 10 feet high, and, therefore, containing just 1,000 cubic feet of air, it would appear from theoretical considerations that a sufficiency was used. In actual practice, however, the Germicide vaporizes about 1½ grains of thymol during each twenty-four hours, equal to 360 grains in a month, or three times as much thymol as theory would indicate as necessary for an air rendered as unhealthy as a raging epidemic could make it. In addition to thymol vapor there issues from the Germicide 2,400 grains of alcohol every thirty days, or an average of 80 grains per diem of a powerful antiseptic added to that of the thymol. It must appear, therefore, from theoretical considerations, that a superabundant antiseptic action is maintained within the closet.

Although the amount of either aerial or liquid disinfectant actually required in practice can only be determined by the actual experience already resulting from the use of the Germicide, still the above considerations suggest that in dealing with disease matter floating in the air, and with volatile disinfectants, highly attenuated forms of matter with subtle properties, and in almost imponderable quantities, are the main elements of this sanitary problem. In this regard the action of disinfectants is by some considered to be almost independent of their quantity, the action being referred to one of *mere presence*, synonymously known as that of catalysis.

The features of the Germicide system, then, can be summarized as follows:

1. It prevents the fermentation of excreta until they have reached the sewer.
2. It maintains within the closets an atmosphere unfavorable to the existence of disease, not by *odorizing*, but by *actual disinfection*.
3. It impregnates the water in traps by a metallic chloride, thus preventing the passage of sewer air by absorption.
4. It prevents traps from emptying by suction or evaporation.
5. It includes, besides a continuous flow of disinfecting solution, a monthly flushing of the soil-pipe with a large volume of the same, transported to each house in a specially constructed reservoir.

It performs all of the above without reliance on the attention or caprice of anybody, but under the guidance of the systematic and competent attendance of an inspector, who visits each house *once every month*.

MECHANICAL DEFECATION

OF

HOUSE DRAINS.

BEFORE attempting to describe what is proposed for the sanitary amelioration of dwellings by the *Germicide System*, (see plate II) it will be shown why it is necessary to do anything more than is *already* advocated by some sanitary authorities.

As upon the speedy and thorough voiding of excreta depends the health of the body, so does the rapid cleansing of the soil pipe and sewer influence the sanitary condition of the house and city. So much has already been written concerning infectious diseases, referring their origin to emanations of accumulated impurities, that mere allusion to the subject will be sufficient in this instance. There is no lack of information concerning the relations of diet, exercise, etc., to health, but it is surprising that comparatively little attention has until lately been bestowed upon the equally important study—how to render our houses healthy by removing those evils which, we are now beginning to discover, manifest themselves in the development of zymotic diseases and the minor afflictions of headache, loss of appetite, debility, and the general lowering of the physical tone. It is not too much to assert that one-half of the sickness and premature mortality in families of large cities is the result of defective drainage.

Aided by those improvements which mechanical ingenuity, guided by a just appreciation of sanitary requirements, has placed within our reach, the present generation has come to enjoy greater immunity from disease than its forefathers. Pests and plagues are becoming almost traditional. Especially in England, where sanitary appliances are so much more perfect than with us, is noticeable the great advance.

If, then, premature mortality is to a great extent within our control, and if one element of its decrease in large towns is the adoption of more perfect systems of house drainage, the subject becomes one of grave importance.

The two chief objects of a perfect system of house drainage should be:

I. The immediate and complete removal from the house of all foul and effete matter directly it is produced.

II. The prevention of any back current of foul air (sewer gas) into the house through the conduits which are removing the foul matter, etc.

The first object, namely, the removal of foul matter, we attempt to fulfill by water-carriage, as ordinarily adopted in the water-closet system. And the usual means relied on to prevent a back current of foul air from sewer or house-drain are water-traps, and air currents induced by certain forms of ventilating shafts.

It is noticed, then, that mechanical means are relied on to attain the two objects mentioned. It will be shown, however, that certain chemical problems are involved in the strict fulfillment of these two objects, and that the best directed mechanical skill, unaided by chemical agency, is inadequate.

The subject, then, of house drainage may be divided into

MECHANICAL AND *CHEMICAL* DEFECATION OF HOUSE DRAINS.

To render the chemical division of the subject more intelligible, the results obtained by mechanical means unaided will be first considered. By observing just what is being ordinarily done in our houses by mechanical agency, we will better appreciate just what is *not* done. By a representation of the house-drainage universally recognized as the most perfect, it will be shown in what consists absolute mechanical efficiency, what are its limits, and consequently what can and cannot be expected from it. It will be seen that in advocating the use of the most approved mechanical systems for the fulfillment of the objects in question, their sphere of importance is not in any degree underestimated or even subordinated to chemical agency. What will be shown, is, that no strictly mechanical system, no matter how modern or improved, can be relied on to successfully achieve the two objects we have mentioned as essential to healthy houses, unless used in connection with a chemical system equally practical and efficient.

Plate I shows a section of a house with four rooms, illustrating a system of house drainage where water is the medium for carrying the daily refuse of the house to the common sewer. The system is represented, at the left, in its simplest and most dangerous form.

The system, however, allows foul gases from the sewer to find entrance into the dwelling. In room 1, for example, the water-tank is seen to have an overflow pipe connecting directly with the soil pipe. The natural effect of this is to allow a direct inlet for sewer gas, which, passing over the surface of the water in the tank, contaminates it, and renders it absolutely dangerous for drinking purposes. The arrows show the course the gas may take, and how it may accelerate the rotting of apples, etc. In room

2, showing a bath and water-closet, the pipe from the closet basin, as also the bath overflow, are seen to pass directly to the soil pipe, opening another avenue to the street sewer. In room 3, however, the most serious consequences are experienced—those influencing the air breathed while sleeping. Here the greatest calamities to health occur especially where there is predisposition to disease. Some surgeons, appreciating the danger to life under certain circumstances from the entrance of foul air from the water-closets or the wash basin into the bed chamber, have actually refused to perform an operation or to allow child-birth in such an apartment until proper means were adopted to prevent the ingress of sewer gas. Room 3 is represented as having a wash stand on the right and a fire-place on the left. With insufficient air entering the apartment, (say from doors and windows being closed on a cold night,) the fire in the grate, seeking its supply of oxygen from some air inlet, is liable to institute a gentle current through the soil pipe. Room 4 shows why the meat spoils and the milk sours so soon in the kitchen or pantry.

In each of these rooms it is noticeable then, that no precautions are taken to stop up the inlet through which the noxious odors from the sewer and soil pipe may enter, to the great detriment of the health of the inmates. This communication to the sewer is so free that anyone in room 2, for example, could, by putting his mouth to the overflow pipe from the tub, be heard to speak by another person in the sewer. This open channel, ramifying into other houses where perhaps infectious disease already exists, is frequently the passage along which germs of disease are carried from the sick chamber to the sleeping rooms of those in health. These openings are, however, necessary, to provide an outlet for the refuse matter of the house, to be carried by water to the sewer. Something must, therefore, be devised, which, while allowing foul water to flow away from the bath tub, wash stand, water closet, sink, etc., will not permit the inflow of sewer air.

Fortunately, by a most simple expedient, this result can be realized. It is only necessary to create, by a loop in the pipe, a sufficient place of lodgment for water, that the pipe at this point may always remain full. Such a device is called a trap, and is nothing more than a water-joint barrier to the passage of air in either direction through the pipes, which, at the same time, allows a perfect flow of water.

On the right of Plate I is represented a house in which the precaution of introducing traps has been taken. Not only are all the pipes leading into the soil pipe thus guarded, but the soil pipe itself, before connecting with the sewer, is also trapped. One of the inherent objections to traps is their liability to become emptied of their water from

various causes. *Now, if a trap becomes empty, its efficacy is destroyed.* The following simple experiment illustrates how this can occur:

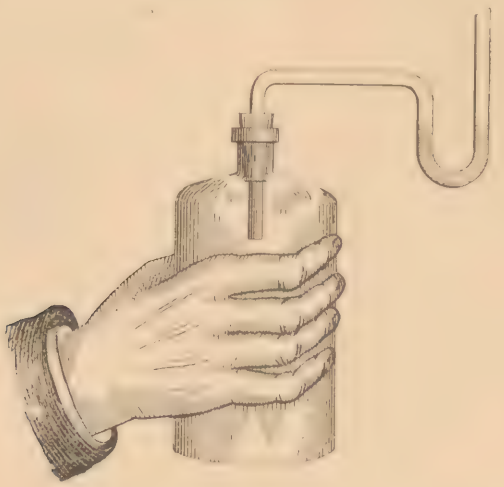


FIG. 1.

Attach a bent glass tube to a bottle, as shown in Fig. 1. Now pour water into the tube until the bend or trap is full. Now expand the air in the flask by holding it in the warm hand, and the water in the trap will be forced out and issue from the top of the tube. If, while the air in the flask is still warm, the trap is again filled, the water will be sucked into the flask as the air cools. This force and suction process is imitated on a powerful scale by the street sewer, which bears the same relation to the pipe traps of dwellings that the bottle bears to the bent tube.

There are various reasons why the sewer has the power of thus emptying traps. After a heavy rainfall, for example, when it is carrying an unusual amount of water, the free space above the usual water level is diminished, and then the air, becoming compressed, can exert sufficient pressure to force out the water from the soil pipe or house traps. Again, sewers emptying into tide rivers (as in this city,) allow the water to creep up further into them at high than at low tide, and pressure on the traps again results. The gases generated within the sewer from decomposing organic matter, also exert an expanding action, just as gases from the stomach produce eructations. As the sewer runs empty of its surplus rain, as the tide ebbs, etc., the pressure, diminishing, establishes a suction action on the traps, and they are then liable to be emptied in the reverse direction, i. e., sucked dry. The remedy, then, of introducing traps as barriers against the entrance of sewer gas, is still incomplete.

The next step in advance allows the soil pipe to be open at its highest point, extending it above the roof. The dotted lines represent this principle in the first house. It is quite evident that no matter how hard the sewer forces air in and out of the soil pipe,

to action on the traps, if any existed, is produced, because the soil pipe is open to the air above. It is obvious, however, that a soil pipe thus ventilated only prevents the traps leading into it from being emptied. The trap in the soil pipe *itself*, where it enters the sewer, can be as readily emptied as before. In this connection, then, it may be observed, that if the soil pipe trap is entirely dispensed with, the soil pipe merely becomes a chimney to the sewer, with its damper removed. This plan of allowing the sewer to gain outlet to the air above the roof of the house, created the system of *sewer ventilation*, which even now has its advocates. The system involves an attempt to prevent the emptying of traps by relieving the sewer of the pressure of foul air, drawing it up through the dwelling and dispersing it above the roof. Each house, then, becomes in itself a sewer-ventilating station. The most important objections to the plan are:

1st. It merely draws up foul air from beneath the street where it is buried, and allows it to issue again above our heads.

2d. It pre-supposes absolute perfection in the stand pipe (or soil pipe) so far as leakage is concerned.

In respect to the first objection, it must be remembered that up to a certain degree ventilation of diseased air is not a stamping out of disease-germs, but a mere dilution. Diluted virus may still possess the power to poison, and it is only when dilution is carried to a certain point that virus becomes harmless. Smallpox virus, for example, after a certain dilution still possesses the power to inoculate. A further dilution, however, renders it innocuous. The ventilation, then, of a sewer by the medium of an open soil pipe pre-supposes a mere dilution, and opens the question whether in all cases the dilution is sufficient to render the sewer air harmless. If, for example, sewer air was issuing above many houses in a block, especially in proximity to windows, the probably inefficient dilution would be manifest, especially on a wet, still night. Wind, on the other hand, would tend to disperse the foul air. The ventilator on the first house being too near the dormer window, the arrows show the course sewer gas might take. A candle flame held against a leakage in the soil pipe would frequently be blown outward, into the room, showing a current of sewer air entering the house.

This plan, if adopted, should have the soil pipe run up outside of, and not through the house. But, to quote English authority, "It is not the business of householders to ventilate public sewers; that is the affair of the authority to whom those sewers are vested. In Croydon, England, the direct connection between public sewers and the pipes which run up the sides of houses is not only dangerous to the houses, but, in relation to public sewer ventilation, the arrangement is little more than a sham."

The case, then, may be stated thus: An open soil pipe is a sewer-chimney of questionable utility; if it has a closed damper, that is, a trap at its entrance into the sewer, it ceases to act as a chimney, and if the trap is absent or empty, smoke might be

seen to enter the house, as well as to issue from the soil pipe, provided sewer gas, like smoke, was visible. On general sanitary principles the house-holder is safer not to invite the sewer and its associations about his dwelling, nor to allow his drainage to be a system of "give and take."

Having, however, demonstrated the efficiency of traps when *full* to cut off the entrance of sewer gas into our rooms, it still remains to devise a plan which, while preventing the sewer from emptying traps, does not institute a direct extension of the sewer into our houses. The radical feature of such a system of drainage is the expedient of disconnecting the soil pipe from the sewer by means of an outlet extending to the surface of the ground, between the house and the soil pipe trap. (see plate I). This principle of disconnection produces the following result: There is now a chimney running up through the house, which is being continually ventilated by *fresh* air entering the shaft in the direction of the arrows, passing up the soil-pipe, and issuing above the roof. This fresh air, constantly pouring into the base of the soil pipe, so dilutes the proportionately small amount of foul air it meets, that what *now* issues above our heads may be considered practically harmless to health.

The soil trap, lying between the air-supply shaft and the sewer, disconnects from the sewer, however, only when it is full of water. The same causes, operating to empty the soil trap still-existing, sewer air might still pass it. The final difficulty may be overcome as follows:

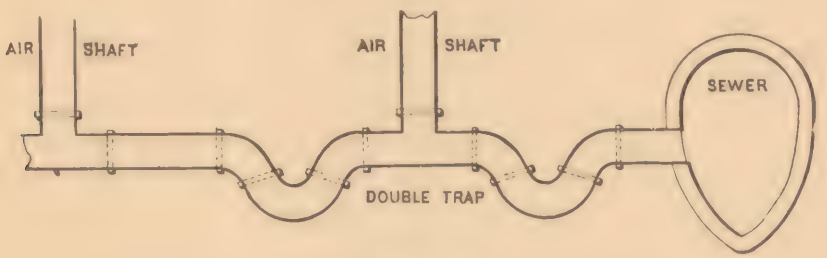


FIG. 2.

Here we have represented two soil traps and two air-shafts. If, now, the first trap is emptied by sewer-suction, the second one still remains full, and the additional air shaft allows the current up the soil-pipe to be uninterrupted.

We have now traced the subject of the *mechanical* defecation of house drains until, by improvements, we have reduced them to their minimum. The result can be epitomised as follows:

MECHANICAL HOUSE DRAIN DEFECATION.

Drains untrapped	permitting	free	entrance of sewer air.		
Drains trapped without provision against syphonage,	"	occasional	"	"	"
Drains with traps protected by air outlets,	"	no	"	"	" except by absorption.

The question now arises: *Does perfect mechanical defecation ensure health and comfort in homes?* The answer may be tabulated as follows:

1st, It does *not* prevent foul air passing by absorption through the water of traps in water closets.

2d. It allows traps frequenfly, by accumulating effete matter, to become small cesspools.

3d. It does not prevent the emptying of traps by evaporation.

4th. It does not neutralize emanations from the person when in the water closet.

Each of these cases which mechanical defecation fails to meet, will be now considered.

1st. PASSAGE OF FOUL AIR THROUGH TRAPS BY ABSORPTION. Absorption of foul air by trapping-water is universally acknowledged by sanitary authorities. With sufficient pressure, water may be made to dissolve large volumes of gas, as, for example, carbonic-acid gas in soda water. But even in the absence of pressure the absorbing capacity of water is very great. Plate III shows a trap connected on the one side with a soil pipe, while the other is supposed to lead up to the basin of a water-closet. The arrows illustrate the course taken by the foul air. Coming in contact with the exposed surface of the trapping-water, it becomes absorbed, and diffusing itself through the water, passes through it and on up to the air of the water-closet, with which it commingles. Now, although the air of a properly ventilated soil-pipe is, as before stated, sufficiently diluted to pass out into the open air without carrying infection, it cannot be admitted that even such air could commingle with the air of the dwelling without endangering health. Much important testimony could be cited from accepted sanitary authorities on the capacity possessed by trapping-water to absorb gases. The following quotation from the By-Laws of the Uppingham Sanitary Authority, 1878, expresses the idea succinctly: "* * as regards the passage of foul gases through the water of traps *when there is no pressure*. Some sanitary engineers have hitherto been disposed to consider that this is rather a theoretical than a practical danger, and that if proper means are taken to secure water traps from pressure they

practically afford a bar against the passage of sewer gases. This is undoubtedly not the case. I have had opportunities of observing several instances of foul gases passing through the trapping-water by being absorbed on one side and given off on the other, and am convinced that this is of frequent occurrence. The passage is, however, gradual, so that if the surface of the water in the trap is freely exposed to the air, the foul gases given off from the water surface are immediately so diluted and dispersed as to be imperceptible. If, on the other hand, the water trap is in a closed pipe or drain, the foul gases which pass through the trapping-water will accumulate on the house side of the trap in sufficient volume to demand attention." Again, in 'Bayle's House-drainage' we read "Long before the point of saturation is reached it begins to give off on one side what it takes in on the other—*when* the point of saturation is reached depends somewhat upon circumstances; * * * but it is a fact within the observation of all who have studied the subject experimentally, that water exposed to contact with confined sewer-gas grows fouler and fouler, and never seems to wholly lose its capacity for absorbing until it becomes putrid, and decomposition takes place within it. In an unventilated trap a water-seal cannot remain pure for many hours. It begins to absorb at once, and the length of time required to so charge it that it will give off gases is probably, as stated by Dr. Fergus, from half an hour to two hours, according to the pressure of the gases in the pipe and their foulness. For this reason every waste pipe, even when ventilated, should have enough water passed through it daily to completely replace the seal in its trap. When the pipes are unventilated, it should be done very often.

Dr. Fergus, a most eminent sanitarian, remarks: "We are therefore very strongly inclined to believe the last alternative, namely, that however well drains may be trapped, sewer-gas will find its way from them into our houses, and any one who is acquainted with Graham's investigations as to the diffusion of gases, will readily understand how this may happen."

The actual passage by absorption of gases, and also of *living germs*, is admirably illustrated by the following experiment: In the fig. *a* and *b* are seen to be two bottles, connected, as shown, with a bent tube *c*. If a small quantity of some such gas as ammonia or sulphuretted hydrogen is introduced into the bottle *a*, it will not immediately pass into *b*, being prevented by the water in the bend of *c*. It will be found, however, owing to the property water has of dissolving these gases, that in a short time they can be detected in *b*,

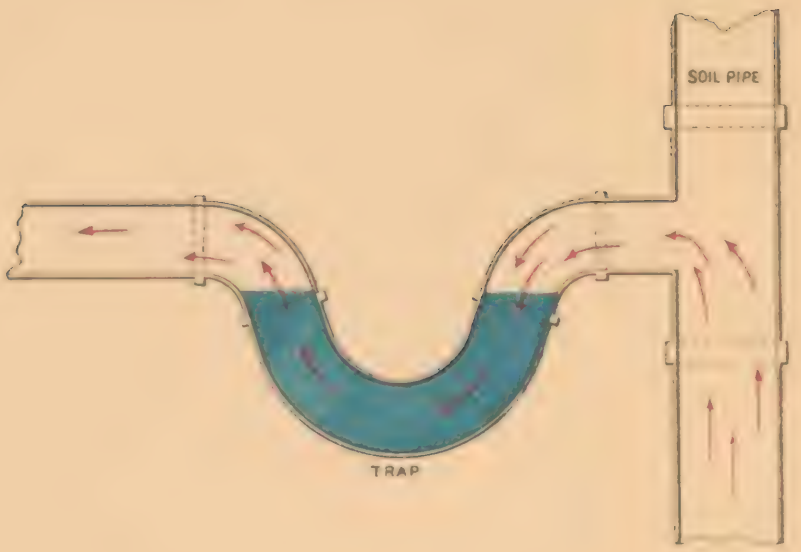


PLATE III

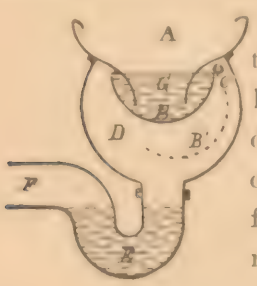
SHOWING PASSAGE OF SEWER-GAS THROUGH WATER IN A TRAP, BY *ABSORPTION*.

having been absorbed by the water in the left-hand limb of the tube *c*, and liberated from it on the side nearest the bottle *b*. If, however, some material is introduced into the water contained in the miniature trap which has the power to combine with and destroy the gases coming from the bottle, these gases will be effectually arrested in their passage and will not enter the bottle *b*. Some nitrate of lead, for example, dissolved in the U-tube, will be seen to turn black very soon after sulphuretted hydrogen is introduced into *a*, entirely decomposing it as it enters the U-tube.

If air containing disease germs (and this is the important part of the experiment), such as zymotic bacteria (which are small living organisms resulting from, or, perhaps, causing, the putrefactive fermentation of dead animal matter, and the accredited cause of contagious disease in living animal matter), is introduced into the bottle *a*, these microscopic germs will pass, together with the air suspending them, through the water in *c*, and will ultimately find their way into *b*. Their presence is detected by introducing into *b* what is termed a fertilizing nidus or nest—that is, some fluid capable of supplying to these germs the conditions favorable to life. And although but a comparatively small quantity of these germs (now believed to be the "contagium vivum" of disease) pass into *b*, they will so multiply in their "nest" or "soil" that the solution in *b* will turn turbid from the presence of its swarm of moving organisms.

Again, if a "germicide" solution, or germ-killer, is put into the water of the little trap, in their passage from *a* to *b* germs will be killed in the trap, and will enter *b* dead and incapable of further reproduction.

2nd. TRAPS BECOME CESSPOOLS.—It is obvious that the deeper the bend of a trap the more water it will hold, but the less likely it will be to become empty by evaporation or pressure. The more water-space it has, however, the more room there is for an accumulation of foul matter to obstruct the flow of water. In view of this latter a very slight seal (*i. e.* water depth) is generally advocated. Dr. Fergus believes "that it is almost impossible, even with a copious flow of water, to cause undecomposed fæces to be discharged through the bend. With any ordinary flow there is only an eddying of the water in the trap, not a sufficient movement of the whole volume to carry floating matters under the bend. 'No mere flow of water will carry out the fæces, which simply keep whirling round in it.' Often with the mistaken idea that by adding a few inches to the depth of water in the trap an effective resistance will be opposed to the pressure of sewer-gas these are made quite deep. Dr. Fergus recommends that the dip or bend should be only sufficient to secure a sealing, for the deeper it is made the more complete will be the retention of decomposing matters at the house side of the trap." Not only do water-closet traps thus become small cesspools within our houses, but the receiver of the ordinary pan-closet itself is a source of foul odor. The single "wash" of the bowl seldom carries off the whole of the last deposit, and the accumulations ferment and putrify, generating foul and disgusting odors.



We illustrate the point by a diagram in which *A* is the bowl, *D* the receiver, (called by an eminent sanitarian the "Chamber of Horrors") *E* the trap and *F* the waste-pipe. When the excreta are dumped from the pan, *B*, they cake and cling to the sides of the receiver and deposit a coating on its inner surface, where it is hidden from view. The water, *G*, in the pan interposes a seal which temporarily shuts out these vapors, pregnant with disease-germs, from the

house. When, however, the pan is dumped, taking the position of the dotted line B', a passage is not only opened directly into the room, but a gallon or more of water is thrown down, displacing so much of the air in the receiver and *forcing* it upwards. Hence the bad smell when the closet is used.

Some most ingenious forms of traps are sold which reduce all objections to their minimum, but it cannot be claimed for any trap that it overcomes *all* objections. To allow foul gases generated in traps to escape, a ventilating pipe is sometimes carried from the trap itself to the roof of the house parallel with the soil pipe. With special forms of closets where fine jets of water are allowed to escape within the receiver, or where valves are used and receivers dispensed with, some objections are diminished, but not entirely overcome.

3rd. Traps emptied by evaporation.—The unsealing of traps by pressure or suction from the sewer has been fully described, and the use of air-shafts to prevent it shown. Evaporation, however, cannot be guarded against by air-shafts. In fact, a rapid current of air through the soil-pipe increases the evaporation of trapping-water. To prevent the fouling of traps their usual form is such as to make them hold but a small quantity of water; but the more shallow the trap, the quicker it will empty by evaporation. Especially is evaporation liable to empty traps, when water-closets are only occasionally used. In warm weather a few days of disuse would be sufficient to cause the trap to become empty sufficiently to permit the passage of foul air through it. During the summer months, when families are away from city houses, the emptying of traps from this cause may, by allowing the entrance of poisoned air into the house, endanger the health of those returning fresh from the country.

4th. Emanations within the closet.—Air contamination within closets, caused by gaseous emanations from the body of the occupant, though perhaps not as yet proved to be a vehicle of contagion, even when coming from a diseased person are, however, sources of air vitiation especially distasteful to the next comer, and no attempt has been made to abate the annoyance.

Having now referred to the benefits to be derived from perfect *mechanical* defecation of house-drains, and indicated what is still unrealized, the supplementary aid of *chemical* defecation, i. e., disinfection will be considered.

CHEMICAL DEFECATION
OF
DRAINS.

MECHANICAL DEFECATION *Transports*—Chemical defecation *transforms* foul matter, and only by the judicious employment of both agents can we ever expect to realize an advance over the present results of house drainage. The transformation of foul matter into other and harmless forms by chemical agency, necessitates absolute contact of the agent employed with the matter to be changed. For example, matter in a water closet basin could not be disinfected by chloride of lime or carbolic acid kept in open vessels within the closet room. The odor rising from such effete matter might be disguised by the more overpowering odor of the lime or acid; but the source of the odor would not be reached. To deodorize is not to disinfect, except where the material giving rise to the bad odor is so changed as to become itself odorless. Deodorizing and disinfecting have been so confounded one with the other that the benefit which might be derived from the judicious use of disinfectants, is usually more than counterbalanced by the disinfectants themselves giving off so strong an odor as simply to conceal the still existing objectionable smell. While bad odor, however, is not a necessary accompaniment of diseased air, still, disagreeable odor in the water closet is a warning that should not be disregarded. Disinfection, however, is often not directed by such knowledge as renders it really subservient to the ends to be accomplished. It has frequently borne more resemblance to some function performed by savages before an idol, than to any reasonable practice of civilized men. There can be no doubt that many of the prevailing ceremonies, such as sprinkling chloride of lime in places of public resort or fumigating with carbolic acid, etc., are not only useless, but even injurious as leading to a false security. Suppose a water closet so constructed that each person after using it was required to pour a bucket of water into the basin to carry the contents off through the soil-pipe. It is quite evident that such a proceeding would be dubbed a nuisance, and water closets would fall into disuse. None would

question the power of the water to carry off the material, but would rather let the material alone than be bothered with using it. Just so with disinfection—if it cannot be applied as easily as is water, by lifting the handle in the seat, in fact, automatically, its capabilities will not be realized. The practical application of disinfection demands that a given amount of the disinfectant used shall constantly and without personal attention be brought in contact with each deposit that goes into the basin. Pouring into the basin at intervals, and only when reminded by the nose, some so-called disinfecting solution, frequently little better than colored water, is disinfection as improperly applied, as would be the bucket of water every time the closet is used.

To the improper application of disinfection can be safely attributed the varied opinion as to the merits of chemical defecation. Even a system possessing inherent good qualities must be of questionable utility if improperly applied. In our opinion, disinfection has never been properly applied to water closets, therefore its qualifications have not been practically demonstrated. Disinfection cannot become an efficient auxiliary to drainage without proper regard to certain essential conditions, namely: It must be

CONTINUOUS, AUTOMATIC AND ECONOMICAL.

If not continuous and automatic, it becomes subject to caprice and neglect, and if not economical, it would be seldom adopted. To meet these conditions essential to successful disinfection, a system will be described which has been found to fulfill the requirements of perfect chemical defecation.

THE GERMICIDE SYSTEM.

The Germicide or germ-killing system is simply a fulfillment of the conditions essential to disinfection, which a just appreciation of its requirements has dictated. The system embraces the following features:

I. It permits a *constant* stream of odorless and colorless disinfecting solution to flow into the basin, passing through the trap and soil-pipe to the sewer.

II. It produces *no odor* in the closet capable of *masking* effluvia, but actually *destroys* them.

III. It generates an aereal disinfectant *only* when the closet is visited, rendering the air innocuous, and grateful to the sense of smell.

IV. It performs its duties *automatically*, without attention from any of the household.

V. When in general use each householder, by constantly allowing a small stream of disinfecting solution to run into the sewer, will aid in *its* purification.

These features are practically realized as follows:

In the accompanying cut is seen a water-closet seat with a vessel attached above it. A concealed pipe, connecting with the water service pipe, conducts water into the vessel, which is previously filled with an appropriate disinfectant in a solid form. The water dissolves this material and then passes by another pipe into the basin below. A constant flow of liquid disinfectant is thus caused to enter the basin and pass through the trap and soil-pipe to the sewer. Within the vessel is a compartment containing Thymoline, which becomes vaporized *only when the closet is visited*. Plate II. indicates a water-closet in section constantly purified by continuous disinfection, representing the Germicide as it actually appears. The "disinfection pipe" issues from the Germicide, passing down behind the casing and entering the basin, where it terminates. The yellow drops from the pipe indicate the course of the disinfecting solution as it mingles with the water in the basin and trap. The arrows from the trumpet mouth indicate the course taken by the disinfecting *vapor*, issuing from the Germicide *only* when the seat lid is first raised. The words "Please close the lid" embrace all the directions required to operate the appliances. An omission to do so does not prevent the continuous disinfection but allows the air in the room to remain unimproved. On entering, the raising of the lid produces the agreeable fumigation of the closet, and the closing of the lid prepares the disinfecting vapor for the next visitor.

Chemical defecation of drains, to be of any real service must not only proceed automatically, and without any care on the part of those to be benefited, but the chemical disinfectant employed must be in *sufficient quantity*. The occasional use of some liquid disinfectant poured into the basin, may be considered of no practical utility. The Germicide could accomplish no *real* good if it contained a *liquid* disinfectant, because it would be too dilute. Containing, however, solid disinfectants in a concentrated form, the water necessary to dissolve the same (and which is not purchased at so much a bottle as is the case when liquid disinfectants are used) is constantly converted into *liquid* disinfectant. Disinfection cannot be effectually applied in a homeopathic manner—at least two barrels a month should be employed in closets constantly used. It is evident then that a sufficient

quantity can only be applied by a method which uses solid disinfectants gradually dissolved by a *continual flow of water.*

The four cases already mentioned, which were found to be beyond the limits of *mechanical* defecation, are entirely controlled by the auxiliary aid of *chemical* defecation as applied by the Germicide system.

1st. THE PASSAGE OF GASES THROUGH THE WATER OF TRAPS and its prevention by the use of a material put into the traps to arrest such passage, was experimentally demonstrated on page 8. The Germicide accomplishes precisely this result, by the constant delivery into the water closet trap of a solution of metallic salts, possessing the required properties. The trap, then, not only offers a *physical* barrier to the rapid inflow of gases generated in the soil pipe or sewer, but by the chemical properties imparted arrests and destroys the hurtful elements of such gases by chemical agency.

2d. TRAPS ARE NO LONGER CESSPOOLS, as their contents are so influenced by the disinfecting properties imparted that the fermentation of fæcal matter is arrested until it passes on to the sewer. Especially during the night hours, when closets are idle, does the great importance of continuous chemical defecation become manifest. The trapping-water at such times exposed for several hours, becomes saturated by gaseous absorption, and the material last deposited in the trap, has ample time to generate foul gases to vitate the air of the closet and house. *Especially at night* should we have *fresh air in our homes.*

The disinfectants employed are well known to possess the power to arrest odors arising from fæcal matter kept in bottles for months. It is however, not the design, in chemical defecation, to prevent permanently, odors arising from such matter, but simply so to say pickle them until, by water carriage, the trap has been relieved of its contents. It is just here that a signal misunderstanding of the proper application of disinfection has existed. Its spasmodic or occasional use, while *mitigating* bad odors, has, because not continuous, allowed such odors continually to reappear. It seems surprising that intelligent persons should so misunderstand disinfection, and think that *occasional* employment can produce *continual* results. Pouring a *concentrated* liquid disinfectant into a water closet basin is a waste of material, for it is soon washed away. It is the constant employment, *day and night* of a *dilute* solution, that both theory and practice show to be the desideratum. Disinfection continuously applied is not only effective but feasible, because economical.

"While a thimbleful of water will extinguish a burning match, many gallons might be inadequate to quench the conflagration the match may originate. Many gallons of

a purifying fluid would be required to defecate the soil pipes, receiver, traps, etc., of some city houses, while a small quantity *daily* employed prevents such necessity."

It is thus seen that sewer-gas is by no means the only source of house air vitiation—the traps, the receivers in pan closets, and the soil-pipes within our dwellings are constantly emanating gases.

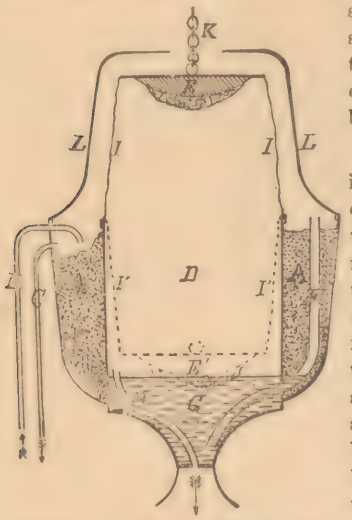
3d. THE EMPTYING OF TRAPS BY EVAPORATION is prevented by the constant and even flow from the Germicide into the basin; and should they become empty by syphonage, a water closet, temporarily out of use would in a short time have its trap refilled. The importance of keeping the traps full is obvious, and during the summer months when the water closet is idle, the constant flow of liquid disinfectant not only prevents the trap from getting empty by evaporation or suction, but also prevents absorption. To return from fresh country air to a house where the atmosphere may be permeated with impurities from drains, etc., and in time of epidemic, perhaps, even with disease germs, is an unwarrantable challenge to nature.

4th.—EMANATIONS WITHIN THE CLOSET are, as has been stated, beyond the reach of mechanical defecation. The trap, which is the plumber's "last ditch," and the receiver under the basin and out of sight sometimes contribute less to the discomfort of the closet, than the source under consideration. The first attempt ever made to overcome this traditional, tacitly accepted and apparently inherent source of discomfort in the water closet on scientific principles is practically realized in the Germicide system. The difficulty in overcoming this evil arises from the fact that in so doing nothing should be employed possessing a sufficiently strong odor to disguise any bad odor from the water closet itself. The only consistent way to destroy the emanations in question, is to cause them *when produced* to come in contact with a disinfectant *in vapor*,* generated at the same time. Such vapor must not be merely a perfume, but must have the power *actually to destroy* and not *conceal* the emanations. A *necessary requisite* is that the disinfecting vapor must be generated only when required, and not give off a continuous odor, as would be the case with any volatile disinfectant kept in open vessels.

* The disinfecting vapor is that of Thymol, which is considered in Europe to be ten times more efficient than Carbolic Acid. As it possesses but little odor, it will no doubt supersede the unpleasant acid now in general use. The Thymoline used in the Germicide is a fluid compound of Thymol.

In the realizing of all these conditions it is evident that a peculiar and original chemical and mechanical combination is required.

The apparatus consists, first, of a symmetrical and ornate vessel of spun metal, enamelled inside, and finished with Japan and gold leaf. It is of the form indicated by the *outline* of the accompanying diagram, which is that of a vase-shaped tank, and its cover *L*, *L*. This vessel is placed at the back and over the closet seat. The annular space *A*, *A* is filled with the mineral disinfectant. A small stream of water is brought up from the service-pipe—or down from the tank, as the case may be—by means of the ¼-inch pipe *B*, the upper end of which constantly *drops* water into the vase, which falls into the basin below, impregnated with the disinfectant.



THE AERIAL DISINFECTION

is performed by another beautiful device. In the centre of the vase is a cylinder, *D*, having a cone-shaped bottom, containing Thymoline. The upper part of the cylinder *D* is surmounted by a truncated cone or cap of rubber, *I*, *I*, sustained in position by the chain *K*. On releasing this chain the weight *E* gradually passes to the position of *E'*, reversing the cone, and expelling the air—saturated with vapor of Thymoline—from the cylinder *D*, through the tube *H*, from which it issues in a jet, as indicated by the arrow. The chain *K* is connected with the seat of the closet, so that as the seat is being closed, after use, the weight *E* and the rubber cap are raised to the position shown in the cut, forming a vacuum in the chamber *D*, which is at once filled by air passing down the filling-tube *F*, bubbling up through the Thymoline solution and becoming saturated with its vapor. The weight *E* is also covered by an absorbent, which dips into the solution and gives it off as vapor, so that the jet which passes into the room is thoroughly impregnated with this powerful disinfectant. When the seat is raised the chain *K* is slacked, and the vapor is expelled, as before, *during the use of the closet.* The column of liquid in the tube *F* acts as a valve in preventing the escape of the air in that direction while it is expelled through the tube *H* by the gentle pressure of the weight *E*. As, however, the tube *H* is only the size of a knitting-needle, the air is forced down through the column of liquid by the sudden and rapid suction as the weight rises. The action is *automatic* and requires no attention, and the construction is thorough, insuring great durability.

To illustrate how completely our estimate of the value of drain disinfection is endorsed by one of the most eminent authorities on disinfection, namely, Dr. Angus Smith, the following interesting quotation from Ure's Dictionary of Arts is given:

"Dr. Angus Smith proposed long ago that sewers should be disinfected nearly from their sources. In other words, disinfectants should flow through all the great sewers, and so bring them to the rivers in a state where putrefaction is impossible. The advantage of this would be great. When Mr. McDougall was showing his plan of disinfecting sewers to the Board of Works the smell of the substance he used when tried in excess was perceived in the houses along the line of the sewers. He completely destroyed the sewer smell. To prevent bad air in sewers, some persons, and among others some in the Board of Health, have proposed ventilation, and have thus polluted towns with the air which, after all, may be better where it was. To obviate this, they sometimes filter the air through charcoal before allowing it to escape. *No plan will succeed* but that which, by preventing putrefaction, precludes entirely the formation of foul air. At present all the lines of sewers are unclean—they may be all cleaned by anti-putrescent substances.

If every family used them, even the smallest drains would be disinfected, with universal benefit. Of course the Thames would cease to putrify, if the larger sewers were all treated in this way."

The following is taken from an interesting circular published by the Sanitary Engineering and Ventilating Co. of London. "It is also *very desirable* that a fluid disinfectant should habitually be liberally mixed, *by a simple mechanical contrivance*, with the water retained in the pans of water-closets. If this were universally done the effect would be continually to flood the sewers with chemical disinfectants, which would destroy the dangerous character of any typhoid excreta which might have escaped proper treatment in the sick room."

In conclusion it may be stated that disinfection, although advocated by the best authorities, has never been applied in dwellings with sufficient system to demonstrate its real aid to drainage. It is not then surprising that many persons still question its utility. We are ourselves willing to admit that although anticipating very marked advantages, resulting from a system of continuous disinfection, we certainly could not have expected such remarkable results as public testimony avers. Probably no newly introduced invention has ever been rewarded by such unvarying approval, as the one we have the pleasure to present.

No matter how thorough disinfection may be it should never be relied upon to remedy any important defects of mechanical defecation. Leakages of a soil-pipe, absence of traps, ventilated soil-pipes opening too near windows, etc., etc., are faults that disinfection cannot reach. Both mechanical and chemical defecation have each their proper sphere, and health becomes endangered when too much is expected of either. If we should be guarding a powder magazine from the sparks of a neighboring fire, we should be careful to prevent not only the entrance of *many* sparks but just as anxious to keep out a single one. So, in purifying our house-drains we should not be satisfied to keep out the *mass* of impure air, but should embrace every opportunity to prevent a single disease germ eluding our efforts and entering our houses. Health in homes is not absolutely insured until defecation is made complete by combined mechanical and chemical agency.

The following List embraces some of the Recent Purchasers of the Germicide:

Name.	*Address.*	*No. Purchased.*
Equitable Life Assurance Society	120 Broadway	1
Mark Shaw	80 East Eighty-first street	2
E. J. Mallett	139 Second avenue	2
U. S. Treasury	Wall and Nassau streets	1
W. H. Smith	206 Third street, East Brooklyn	1
Sinclair Hotel,	Broadway and Eighth street	1
Michael Gillon	21 Cole street, South Brooklyn	1
C. P. Woodworth	250 South Ninth street, South Brooklyn	1
Thomas Cummings	226 Eleventh street, South Brooklyn	1
Rev. Dr. Deems	429 West Twenty-second street	1
Dr. E. Lambert	3 East Thirty-seventh street	3
Chatham National Bank	200 Broadway	1
E. A. Hutchins	357 Lewis avenue, Brooklyn	1
Niagara Fire Insurance Co	201 Broadway	1
National Shoe and Leather Bank	271 Broadway	1
E. L. Christianson	173 East One Hundred and Thirteenth st	1
J. W. Scammell	231 Greene avenue, Brooklyn	1
J. G. Norman	26 Second street, South Brooklyn	1
J. Thompson	318 President street, Brooklyn	1
M. Sharkey	527 Sixth avenue	1
Chas. Graef	132 Amity street, Brooklyn	2
New York Hotel	721 Broadway	3
Greenwich Insurance Co	151 Broadway	1
Mutual Life Insurance Co	142 Broadway	1
J. F. Trow (City Directory)	205 East Twelfth street	1
Otto Witte	308 Herkimer street, Brooklyn	1
J. J. Dowd	439 Broadway	2
Theodore Stewart	8 Warren street	1
F. Hollender	273 Broadway	1
F. Hollender	Staats Building	1
St. Denis Hotel	Broadway and Eleventh street	4
N. Y. Mutual Gas-light Co	36 Union square	2
R. M. Hedden	61 Morton street	1
Ferdinand Earle	48 East Fifty-third street	1
Dr. A. G. Winkle	59 East Fifty-ninth street	1
J. W. Beach	14 Hanover place, Brooklyn	1
Martin B. Brown	770 Lexington avenue	1
Tiffany & Co	Union square	1
J. M. Duryee	10 West Thirty-eighth street	1
Geo. H. Stover	227 Greene avenue, Brooklyn	1
W. H. Henry	Sup't N. Y. Herald	2
East River National Bank	682 Broadway	1
Department Charities and Correction	Third avenue and Eleventh street	1

The following Letters express the usual Opinion of those who have tried the Germicide System:

NEW YORK, October 20, 1879.

Messrs. GEO. H. KITCHEN & Co , 591 Broadway, N. Y.:

DEAR SIRS—The Germicide which you put in my house, 231 Greene avenue, Brooklyn, I am pleased to say works admirably, giving entire satisfaction, and I should regret any circumstance which would deprive my family of its use. As a disinfector it seems to be perfect.

Your obedient servant,
J. WALTER SCAMMELL,
231 Greene Avenue, Brooklyn.

EQUITABLE LIFE ASSURANCE SOCIETY,
NEW YORK, October 20, 1879.

Messrs. GEO. H. KITCHEN & Co.:

The "Germicide" has been in use in the water-closet attached to the Medical Department rooms of this institution for some months, and since its introduction all foul odors have disappeared from such closet.

EDWARD CURTIS, M. D.

NEW YORK, October 22, 1879.

Messrs. GEO. H. KITCHEN & Co.:

The "Germicide" which you placed in one of our closets has proved effectual in destroying the bad gases arising from the closet, and in imparting a pleasant odor to the room and its surroundings.

Respectfully yours,
TROW'S PRINTING AND BOOKBINDING CO.,
205-13 East Twelfth Street.

NEW YORK, October 22, 1879.

Messrs. GEO. H. KITCHEN & Co.:

GENTLEMEN—I have had in use at my house one of the "Germicides" put up by you, and find it admirably adapted for its purpose; it does its work most effectually, as I have experienced none of the evil effects of sewer gas since it has been put up.

Very respectfully,
R. M. HEDDEN, 61 Morton Street,
Of the Department of Charities and Correction.

NEW YORK, November 20, 1879.

Messrs. GEO. H. KITCHEN & Co , 591 Broadway:

I have used the Germicide at the Equitable and at my own house. It has entirely removed all the sewer gas and smell from the closet at the Equitable office, and it has rendered the closets at my residence free from such odors as are common to almost every water-closet. The antiseptic effect of the chloride of zinc and thymol upon decomposing animal and vegetable substances are well known and generally recognized. It seems to me that this appliance will be of great efficiency in removing causes of disease.

E. W LAMBERT, M D.,
Medical Examiner Equitable Life Assurance Society.

NIAGARA FIRE INSURANCE CO.,
NEW YORK, October 20, 1879.

Messrs. GEO. H KITCHEN & Co., 591 Broadway:

GENTLEMEN—The Germicide placed in one of our closets, previously abandoned as too offensive for use, has rendered it pleasant, and free from disagreeable odors.

Respectfully,
J. W. WIGGINS, JR., Cashier.

NEW YORK, September 10, 1879.

Messrs. GEO. H. KITCHEN & Co., 591 Broadway:

Some weeks ago I lost a child by diphtheria, and for a month past my wife has suffered from malarial fever, and has been under medical treatment, taking much medicine. I knew that we had sewer gas from the water closet, and becoming convinced that it was the cause of her illness, I had the Germicide put in. At the end of one week she had fully recovered. I believe that the Germicide is a perfect antidote and preventive of sewer gas, and I am very thankful to you for having induced me to adopt it.

I am also much pleased with the perfume which the apparatus diffuses, and enjoy my visits to the closet accordingly.

I shall recommend the Germicide to all my neighbors, and you can refer to me at all times.

E. L. A. CHRISTIANSON,
173 East 113th Street.

NEW YORK, September 10, 1879.

Messrs. GEO. H. KITCHEN & Co., 591 Broadway:

I am much pleased with the working of the Germicide at the Sub-Treasury, and have no doubt that it will do all that it is recommended of it.

D. G. GAYWOOD,
Superintendent

NEW YORK, November 20, 1879.

Messrs. GEO. H. KITCHEN & Co., 591 Broadway:

DEAR SIRS—The two Germicides that you put in my house I am pleased to say work admirably, continuing to give entire satisfaction, to the pleasure of myself and family. And I believe it to be a very necessary thing as a disinfector.

Yours, very truly,
MARK SHAW,
80 East 81st Street.

BROOKLYN, October 21, 1879.

GEO. H. KITCHEN & Co.:

I take pleasure in expressing my entire satisfaction with the operation of the Germicide. Your system of disinfection illustrates the fact that the odor we have been so long accustomed to associate with water-closets is no longer a necessary evil.

Yours truly,
J. G. NORMAN,
26 Second Street, Brooklyn.

NEW YORK, October 20, 1879.

Messrs. GEO. H. KITCHEN & Co. :

GENTLEMEN—The Germicides you put up in my house, No. 132 Amity street, Brooklyn, give complete satisfaction.

I look upon them as complete disinfectors, and I recommend them to everybody. Yours truly,

CHARLES GRAEF.

Messrs. GEO. H. KITCHEN & Co. :

GENTS—The disinfection of water-closets, automatically, by a continuous process, is one which I believe will overcome the objection to disinfection as formerly employed.

The odor from the Thymol, although appreciable, is not, in my opinion, sufficiently marked as to mask any bad odors coming from the closet, but appears rather to destroy them.

I may add that the three sold to me are still giving satisfaction. Yours,

H. CRANSTON,
Proprietor New York Hotel, 721 Broadway.

Messrs. GEO. H. KITCHEN & Co.:

GENTS—I consider the principle upon which the Germicide operates as fulfilling what is required in a sanitary way.

The continuous disinfection of what passes into the closet-basin, together with the destruction of odors sometimes generated in the room, appears to be realized. I think the use of a disinfectant having so slight an odor as Thymol to be much preferred over anything having a decided odor. Yours,

A. V. STOUT,
Pres. Shoe and Leather Nat. Bank, 271 B'way.

NEW YORK, October 22, 1879.

Messrs. GEO. H. KITCHEN & Co.:

GENTS—One of your "Germicides" has been in use in this office during the past three months and has given perfect satisfaction.

I believe it to be an excellent instrument for the disinfection of sewer gases. Yours respectfully,

JACOB HESS,
Commissioner Public Charities and Correction.

NOVEMBER 5, 1879.

GEO. H. KITCHEN & Co.:

GENTLEMEN—The Germicides purchased of you have been very thoroughly tested in my hotel. Both the gentlemen's and ladies' closets are entirely deodorized. The fact that they constantly work without attention is a great recommendation, and I am pleased to speak so favorably of them.

Respectfully yours,

WILLIAM TAYLOR,
Prop. St. Denis Hotel, B'way and 11th St.

N. Y., October 21, 1879.

GEO. H. KITCHEN & Co.:

GENTLEMEN—I think your system of continuous disinfection is a great advance in sanitary economy. Although disinfectants are known to be essential to the maintenance of health, unless used automatically, I do not consider them of value, as we are too apt to neglect them. Your invention cannot fail to be of great importance, and in my case has surpassed my expectations. Yours, etc.,

JOHN J. DOWD, 439 Broadway.

NEW YORK, October 20, 1879.

Messrs. GEO. H. KITCHEN & Co. :

GENTLEMEN—The Germicide which you put in my house has worked well, and gives entire satisfaction to my family and myself. Yours truly,

E. A. HUTCHINS,
357 Lewis Avenue, Brooklyn.

BROOKLYN, October 22, 1879.

Messrs. GEO. H KITCHEN & Co. :

GENTLEMEN—The Germicide placed in my dwelling some three months ago has given perfect satisfaction and rendered the water-closet free from all obnoxious gases

As a disinfector I consider it of the greatest importance in maintaining a healthy atmosphere in the dwelling. THOMAS CUMMINS,
226 Eleventh Street, Brooklyn.

MUTUAL LIFE INS. Co., }
NEW YORK, October 19, 1879. }

GEORGE H. KITCHEN & Co. :

I take pleasure in recommending your "Germicide." It has been in operation in this office for three months, and has been thoroughly effective in its results. As a deodorizer it is perfect, and upon the principle of its construction I believe it to be what it claims, a Germicide. Very respectfully,

WALTER P. GILLETTE,
Medical Examiner.

NEW YORK, October 21, 1879.

GEO. H. KITCHEN & Co :

GENTLEMEN—I believe that sanitary science owes much to your improvement in disinfection. If a few persons in every block in the city should adopt the system I think sewer gas would be entirely obviated. I cannot but believe that the Germicide will come into universal use. Respectfully,

OTTO WITTE,
Bullion Broker, No. 1 Wall Street.